King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

MATH 202 - Class Test - Term 132

Duration: 120 minutes

Name:______________________________ ID Number:______________________________

Section Number:____________________ Serial Number:____________________________

Class Time: ________________________ Instructor's Name:______________________

Instructions:

1. Calculators and Mobiles are not allowed.
2. Write neatly and eligibly. You may lose points for messy work.
3. Show all your work. No points for answers without justification.
4. Make sure that you have 9 pages of problems (Total of 9 Problems)

Page Number	**Points**	**Maximum Points**
1		5
2		8
3		8
4		9
5		8
6		12
7		14
8		8
9		8
Total		80

1. **(3 points)** Find an interval centered about $x = 1$ for which the following a) Initial Value Problem has a unique solution

$$(x^2 - 4)y'' + 2xy' - 3y = 0, \ \ y(1) = 0, \ \ y'(1) = -1$$

b) **(2 points)** Given that $y = c_1 x + c_2(1 + x^2)$ is the general solution of a differential equation. Find values of c_1 and c_2 for the Boundary Value Problem of the same equation with the boundary conditions $y(0) = 0$ and $y(1) = 1$.

2. **(8 points)** Verify that $y_1 = \sin(x^2)$ and $y_2 = \cos(x^2)$ form a fundamental set of solutions of the differential equation $xy'' - y' + 4x^3y = 0$ on the interval $(0, \infty)$. Form the general solution

3. **(4 points)** a) Verify that $y_{p_1} = xe^{-x}$ and $y_{p_2} = x^2 - 8x + 23$ are respectively, particular solutions of

$$y'' + 3y' + y = (-x+1)e^{-x} \text{ and } y'' + 3y' + y = x^2 - 2x + 1$$

b) **(4 points)** Use part(a) to find a particular solution of

$$y'' + 3y' + y = (2x-2)e^{-x} + 3(x-1)^2$$

4. **(9 points)** Given that $y_1(x) = x + 1$ is a solution of the differential equation $(1 - 2x - x^2)y'' + 2(1 + x)y' - 2y = 0$. Use reduction of order to find a second solution $y_2(x)$.

5. **(8 points)** Solve $4y^{(4)} - 4y''' + 9y'' - 8y' + 2y = 0$ given that $y_1 = xe^{\frac{1}{2}x}$ is one of the solutions.

6. **(12 points)** Solve $y'' + 4y = \cos^2 x$ by undetermined coefficients method.

7. **(14 points)** Solve $y'' - 2y' + y = \dfrac{e^x}{1+x^2}$.

8. **(8 points)** Use the substitution $x = e^t$ to transform the equation

$$x^2y'' - 4xy' + 6y = \ln x^2$$

into a differential equation with constant coefficients.
(Do not solve the new equation)

9. **(8 points)** Solve

$$x^3y''' + xy' - y = 0$$